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ABSTRACT

This paper reports on three longitudinal studies of the relationship of mother-infant interaction (and other maternal characteristics) to child development. The goal of the research program was to find a way to break the chain of events that lead to mild mental retardation. The first study of 1,000 North Carolina first grade children showed that the child's race and the mother's level of education at the time of the child's birth accounted for 27 to 29 percent of the variance in performance on three measures of intelligence and achievement. The second study examined the effects of an intensive intervention day care program with ancillary family services on the mother-child dyad and on the child. Fifty-seven children who had family characteristics most predictive of school failure were identified and followed during the first three years of life. The IQ of mothers in an untreated control group continued to predict her attitudes, interactional behaviors, and the child's development at three years of age. In the experimental group, the relationship between maternal IQ and child IQ was reduced to nonsignificance. Preliminary findings from the third study of mothers participating in a home visitation program indicate that the control-group mother spends more time involved with her child. Four tables of explanation and statistical documentation are included. (Author/RH)

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Maternal Characteristics and Intellectual Development: Implications for Parent Education to Prevent Sociocultural Mental Retardation

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Maternal Characteristics and Intellectual Development: Implications for Parent Education to Prevent Sociocultural Mental Retardation

Craig T. Ramey and Jean W. Goven

The majority of children who are classified as mildly retarded appear to be free of discernible biological handicaps (Dunn, 1968). Their handicap is presumably due more to sociocultural factors than to organic damage or deficit. This suggests that if one can identify the chain of factors through which socioeconomic conditions are causally related to this form of mild retardation and discover effective means for altering these factors, then we can make progress toward reducing the incidence of mild mental retardation. An underlying assumption for the research to be reported today, is that the parents provide for the young child the final causal pathway through which cultural factors affect the development of the child. This thesis does not free the greater society from responsibility for the development of its children, but simply postulates one part of the mechanism for societal effects.

The research to be reported today examined the relationship of mother-infant interaction and other maternal characteristics to the subsequent developmental levels of their children. Specifically, it addressed the following two questions: Who are the children who are most at-risk for mild mental retardation? That is, what are the early maternal and child predictors of subsequent intellectual deficits? And, secondly what are the effects on both mother-child interaction and subsequent child performance of two types of early education programs? These issues were examined in three longitudinal studies at the Frank Porter Graham Child Development Center. Since there are a great deal of data to be presented we have summarized the results from each

of these studies in the tables which appear in your handout.

The first study was a retrospective longitudinal study in which information available from birth certificates was used to predict the psychological and educational status of a random sample of 1,000 first-grade, North Carolina children as measured by four tests which are briefly described in the handout. In a discriminant-function analysis, the following predictor variables significantly discriminated the moderate- and low-risk children: mother's level of education, race, month prenatal care began, survivorship of older siblings, and the child's birth order and legitimacy. Multiple regression analyses revealed that the mother's level of education at the time of the child's birth and the child's race together accounted for 27 to 29 percent of the variance in the child's first grade performance on three of the measures of intelligence and academic achievement: (the Peabody Picture Vocabulary Test, the Tests of Basic Experiences and the Myklebust Pupil-Rating Scale).

This finding that Black children of under-educated mothers preformed poorly in school is not surprising considering the history of racially related disadvantage which has so severely limited the educational, occupational and social opportunities of Blacks in North Carolina as well as elsewhere in our nation. It is therefore, likely that the variance added by race to the prediction accounted for by maternal educational level alone, was mediated by such factors as employment and health status.

The second longitudinal study, to be discussed today, examined what happens, both to the mother-child dyad and to the child, when families are selected according to these risk factors and treated in an intensive

intervention day care program with ancillary family services.

In a prospective longitudinal study, a sample of 57 children who possessed the characteristics most predictive of school failure were identified and followed during the first three years of life. These children were identified using the High Risk Index reported by Ramey and Smith (1977). This index includes such factors as parental education, income, maternal IQ, history of social or emotional problems, evidence of sociocultural retardation in other family members, intactness of the family and need for public assistance. At birth, each child in the sample was randomly assigned to an Experimantal or Control group. Experimental children attended an eight-hour-per day, five-days per week, center-based day care program from the time they were three months old. In both groups, families received social services and children received nutritional supplements and health care.

In the results presented today, the criterion variable is the child's Stanford-Binet IQ as measured at age three years. The predictor variables include the mother's intelligence as measured by the WISC or the WAIS, the mother's childrearing attitudes as assessed by Emmerich's (1969) revision of Schaefer and Bell's (1958) Parental Attitudes Research Inventory (PARI), mother-child interaction in the home assessed by Caldwell's (1970) Home Observation for Measurement of the Environment (HOME) and several measures of mother-child interaction in the laboratory at ages 6 and 20 months.

Results from this high-risk sample indicated that even within this relatively homogeneous sample, the IQ of mothers in an untreated control group continued to predict both her attitudes and interactional behaviors as well as the child's developmental outcome at three years of

age as assessed by the Stanford-Binet IQ test. In the experimental group, the relationship between maternal IQ and child IQ was reduced to nonsignificance. However, the experimental group mothers' child-rearing attitudes and their behaviors toward their children were quite similar to that of the control group mothers. In other words, in the absence of an intervention program, there is a fairly strong relationship between maternal IQ, childrearing attitudes and behavior and the child's subsequent intellectual performance. An intensive center-based educational program for the child, beginning at age 3 months, breaks this relationship so that, even though the maternal characteristics are apparently unaffected, the child's IQ, as well as the relationship between the two classes of variables, is affected.

These results suggest that what goes on, educationally, in the life of the young child, makes a difference. Hypothetically, similar educational activities can occur in a daycare center or in the child's home or in both places. With the results of the other two studies in mind, a third longitudinal prospective study was designed to examine the effect on both mother-child interaction and child outcome of a home-based parent education program. Twenty-four families identified by the High Risk Index were assigned in October, 1978, to one of three groups: a home visitation group (n=12), a home visitation plus day care group (n=6), and a control group (n=6).

Before discussing the results which we have, to date, from this third study, I want to briefly sketch for you the rationale for having a home-based program and for the content of this program.

Our earlier studies, as well as the work of other researchers (e.g., Coleman, 1966), had demonstrated that there is a disproportionate

number of children suffering from mild mental retardation who come from economically and educationally disadvantaged families. Further, it has been suggested that the intellectual deficit presented by these children can be ameliorated by making a substantial alteration in the child's early educational environment. Moreover, the reduction to insignificance of the usual correlation between maternal and child IQ in the children receiving our daycare program argues against a strongly genetically determined association of SES factors and child intelligence. However, although certain characteristics of the family, such as level of education, parental IQ, and income, correlate significantly with child IQ, these correlations do not in and of themselves constitute evidence of a causal relationship nor do they indicate how these demographic factors translate into childrearing behaviors.

In a review of longitudinal studies of family correlates of child outcome within the low-SES population, Gowen (1978) identified characteristics of interactions of low-SES mothers and their young children which correlated significantly with measures of the child's subsequent academic and intellectual performance. The maternal behavior which appeared to be most predictive of later child cognitive performance in these studies was maternal verbal stimulation and responsivity. This conclusion fits well with findings from item analyses of intelligence test scores and other studies which indicate that language is a major component in the relatively lower intellectual performance of lower-class children (Eells, Paris, Havighurst, Herrick & Tyler, 1951; Ramey & Campbell, 1979).

In summary, we had <u>experimental</u> evidence that the course of the child's intellectual development can be changed by altering the

child's environment. And we had correlational evidence associating not only demographic factors but also specific childrearing behaviors with mild mental retardation. It became apparent that what was needed was a study which would indicate whether these childrearing behaviors could be changed in a more intellectually helpful direction in low-SES mothers and whether or not these changes would result in sustained improvements in intellectual performance in the children. With these questions in mind, the Carolina Approach to Responsive Education, Project CARE, was designed.

Time does not permit a description of Project CARE's program. There are references, however, in your handout to articles describing this project as well as some of the other research discussed today (e.g. Ramey, Sparling & Wasik, 1979).

A major hypothesis of Project CARE was that the nature of the mother-child interaction could be modified through an educationally oriented home visitation program carried out by Family Educators. This hypothesis is being examined by assessing mother-child interactions in the home and in a laboratory at regular intervals and through the administration of a battery of tests to both the mother and the child. Data from our assessments when the infants were 6 months of age are now available for most of our subjects.

The data which are most pertinent to our topic today, that is, to the question of the effect of a home visitation program on the interaction of mothers with infants who are considered at risk for mild mental retardation, are the observations of mother-child interaction in a semi-naturalistic setting. Data were available for 10 mother-child dyads from the home visitation groups and 5 control group

dyads. To bring the control group to a sample size, equal to that of the experimental group, 5 additional subjects were randomly selected from a previous cohort which had also been constituted through the process of random assignment. Mother-child interactions were scored using a behavioral scoring system developed by Farran and Haskins (1977) and modified by Burchinal (1978). Means, standard deviations, and t-test values for those variables which significantly differentiated the home visitation from the control group are presented in Table 4. As you can see from these results, mothers in the home visitation group spent less time away from their infants and more time holding them and in mutual play than did control group mothers. Furthermore, they more frequently joined ongoing child activities and stayed with these activities longer. Mothers in the control group on the other hand, spent more time reading to themselves and had infants who spent more time either playing alone or not involved in any discernible activity.

We present these results with a great deal of caution because they are preliminary and need to be validated by later analyses of data from the complete sample which we are still recruiting. In future analyses we will determine whether these group differences hold across time and will examine the nature of their relationships to child outcomes. In addition, we hope to learn something about individual differences regarding the preference for, and the effectiveness of, different types of early intervention programs. For example, what are the characteristics of families who benefit most from parent education in contrast with families who benefit most from day care? The overriding goal of this research is to find a way to break the chain of events which eventuate in mild mental retardation.

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Table 1

Instruments Used in the Retrospective Study
to Measure the Educational Status of
First Grade Children

1. Peabody Picture Vocabulary Test. (PPVT) (Dunn, 1965). This test, which is individually administered, was designed to provide an estimate of the child's verbal intelligence by measuring receptive-language vocabulary.
2. The Tests of Basic Experiences. (TOBE) (Moss, 1972). A series of standardized group tests for young children, the Tests of Basic Experiences were designed to increase understanding of the child by providing an indication of how well his experiences have prepared him for introduction to the scholastic activities to be encountered in school. Four subtests were used in this study: Mathematics, Language, Science, and Social Studies.
3. Beery-Buktenica Developmental Test of Visual-Motor Integration. (Beery, 1967). This test is a measure of the degree to which visual perception and motor behavior are integrated in young children. It is basically a tool for educational assessment that may be administered in either individual or group settings. In this instance, we used the individual administration.
4. Myklebust Pupil-Rating Scale. (Myklebust, 1971). This scale is a screening procedure for identifying and classifying children who may have a learning disability. Five areas of behavior are included: auditory comprehension, spoken language, spatial and temporal orientation, motor coordination, and personal-social behavior. The children's teachers provided ratings on the Pupil-Rating Scale.

Table 2

DISCRIMINANT-FUNCTION ANALYSIS BETWEEN FIRST GRADERS SCORING −1 STANDARD DEVIATION (*SD*) OR MORE BELOW THE MEAN AND THOSE SCORING AT THE MEAN OR HIGHER ON PPVT, VMI, TOBE, AND PUPIL-RATING SCALE (SEVERE DEVELOPMENTAL DELAY)

Variable	−1 *SD* or less (*n* = 25) Mean	*SD*	Mean and higher (*n* = 195) Mean	*SD*	*F* (1/218 *df*)	Standardized discriminant-function coefficients
Birth order	3.36	2.38	1.98	1.09	24.92*	−.281
Age of mother	24.92	7.19	25.32	5.24	.12	.158
Education of mother	9.68	1.93	12.28	2.01	37.30*	.295
Previous live births now dead	.16	.37	.01	.07	26.61*	−.392
Previous fetal deaths	.28	.68	.22	.55	.24	−.047
Birth weight	5.80	1.38	6.14	1.09	2.05	.125
Month care began	3.36	1.87	2.63	1.24	6.79*	.100
Number weeks gestation	38.48	4.65	39.34	2.44	2.14	−.161
Sex						
Male	60%		54%		.34	−.015
Female	40%		46%			
Race						
Black	64%		8%		78.12*	−.618
White	36%		92%			
Legitimate birth						
Yes	76%		96%		15.64*	−.172
No	24%		4%			

Note. PPVT = Peabody Picture Vocabulary Test, VMI = Visual–Motor Integration, TOBE = Tests of Basic Experiences

* $p < .01$

from Ramey, Stedman, Borders-Patterson, and Mengel, 1978.

Table 3

MULTIPLE REGRESSION OF PREDICTOR VARIABLES

ON PEABODY PICTURE VOCABULARY TEST

Variable	Multiple R	R^2	R^2 change
Race	.44	.19	.19
Education of mother	.52	.27	.08
Sex	.54	.29	.01
Month care began	.55	.29	.00
Age of mother	.55	.30	.00
Birth order	.56	.31	.01
Legitimacy	.56	.31	.00
Previous live births now dead	.56	.31	.00
Number weeks gestation	.56	.31	.00
Birth weight	.56	.31	.00
Previous fetal death	.56	.31	.00

from Ramey, Stedman, Borders-Patterson,

and Mengel, 1978.

Table 4

Means and SDs of Mother-Child Interaction Behaviors

Behavior	Home Education (n=10) Mean	SD	Control (n=10) Mean	SD	T Value
1. Mutual play (frequency)	20.0	8.7	10.0	7.5	2.75**
2. Mother joins child's play (frequency)	9.7	7.4	3.2	3.2	2.54*
3. Duration of play once mother joins (sec.)	189.3	149.5	48.3	62.6	2.75*
4. Mother far from child (total duration, sec.)	23.8	48.2	223.2	274.0	2.27*
5. Mother holds child (total duration, sec.)	453.4	285.8	180.8	196.9	2.48*
6. Mother reads alone (total duration, sec.)	28.7	58.1	329.5	345.0	2.72*
7. Infant involved in no activity (total duration, sec.)	143.7	118.6	280.7	161.8	2.16*
8. Infant playing alone (mean length, sec.)	12.2	4.4	21.1	10.9	2.39*

* $p < .05$

** $p < .001$